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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor:

Peter Michael Edic et al.

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For: METHOD AND APPARATUS
FOR GENERATING
TEMPORALLY INTERPOLATED
PROJECTIONS

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Group Art Unit: 2882

Examiner: Ho, Allen C.

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Florin C. Faries

Florin C. Faries

**REPLY BRIEF PURSUANT TO 37 C.F.R. § 41.41 AND IN RESPONSE
TO THE EXAMINER'S ANSWER MAILED SEPTEMBER 21, 2007**

This Reply Brief is being filed pursuant to 37 C.F.R. § 41.41 and in response to the Examiner's Answer mailed on September 21, 2007. Specifically, this Reply Brief addresses the Examiner's continuing pattern of misinterpretation of Morgan, U.S. Patent No. 6,229,870 and Casey et al., U.S. Patent No. 5,175,754 (hereafter "Morgan" and "Casey" respectively) and the pending claims. However, in the interest of brevity, Appellants address below only those issues or arguments raised the Examiner's Answer that are particularly noteworthy. In view of Appellants' attempt to avoid repetition in this Reply, Appellants respectfully request that the Board consider Appellants' complete arguments set forth in the previously filed Appeal Brief.

Feature of Independent Claims Missing from Cited Combinations

All independent claims 1, 9, 17, and 25 generally recite that the rotational period of the distributed X-ray source is *greater* than eight seconds. This feature is not taught or suggested by the cited references, whether the references are taken alone or in combination. The Examiner acknowledged that the primary reference (Morgan) does *not* disclose this feature, but then relied on Casey to teach this feature. *See* Final Office Action, pages 2 and 3. Yet, the largest value disclosed in Casey is 8 seconds, not *greater* than 8 seconds. In the Examiner's Answer, the Examiner asserted that the 8 second value disclosed in Casey "is only an example." *See* Examiner's Answer, page 12 (citing Casey, col. 1, lines 44-46). Appellants do not necessarily agree that the 8-second value is only given as an example, this is beside the point. Nevertheless, because the Examiner has failed to show that the cited combination includes a rotational period greater than 8 seconds, the Examiner has not shown that the cited combination includes all of the presently-claimed features. reasoning (of decreasing the rotational speed to a greater than 8 second rotational period to increase image resolution)

The Examiner's reasoning rests on the premise that by rotating the X-ray source of the Casey reference slower than eight seconds per rotation, more than 7,872 projections can actually be acquired, i.e., that the CT machine is capable of emitting X-rays at more than 7,872 angular positions. *See* Casey, col. 1, line 61 – col. 2, line 5. Absent some showing by the Examiner that the commercial CT system as described in the Casey reference is actually capable of acquiring projection data at more than 7,872 angular positions in one rotation, one of ordinary skill in the art would *not* believe it appropriate to increase scan time to merely get the *same* amount of projection data. In other words, once the number of projections that can be acquired in a rotation is maximized, the resolution is also maximized, and *simply rotating the X-ray source slower won't result in any improvement in resolution*, i.e., more projections won't be acquired.

The Examiner stated that "appellants have not provided any support for this allegation." Examiner's Answer, page 15. However, Appellants stress that it is the Examiner's burden (not Appellants' burden) to establish a *prima facie* case of obviousness. *See Ex parte Wolters and*

Kuypers, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). The Examiner has failed to do so here. Moreover, it should be noted that Appellants believe that the 8 second value per revolution for rotational speed taught by Casey is a maximum value. Indeed, this is implicit in the statement in Casey that “a commercial CT machine may take *up to* 7872 projections per revolution during a single eight second revolution of the gantry. *See* Casey, col. 1, lines 64-66 (emphasis added). Further, the only other value taught by Casey is a lower value of a two second revolution of the gantry. *See* col. 1, line 67 – col. 2, line 5. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

The Examiner also stated:

Secondly, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *See In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The disclosure of Casey et al. was only relied upon to teach the relationship between a rotational period and the quality of a tomographic image. One of ordinary skill in the art would recognize the fact that a longer rotational period would necessarily require a CT capable of acquiring and processing additional projections. Modifying and/or upgrading a CT to accommodate additional projection data is well within the capabilities of a person skilled in the art.

Examiner’s Answer, page 15. However, Appellants stress that the Examiner must show that the cited combination discloses all of the claimed features. Neither reference teaches a rotational period of greater than eight seconds.

Moreover, while the general relationship between rotational period and resolution (and a knowledge of certain modifications or upgrades to a CT system) may be understandable to the skilled artisan, there must be an *appropriate* reason (which the Examiner has not provided) to

modify the Morgan CT system of the primary reference. *See KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d 1385 (U.S. 2007) (“[R]jections based on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”) (quoting *In re Kahn*, 441 F.3d 977,988 (Fed. Cir. 2006)). As discussed below, the Examiner’s reasoning to decrease the Morgan rotational speed to a greater than 8 second rotational period (to increase image resolution) is at least incomplete.

For these reasons, the independent claims (and their dependent claims) are believed to be patentable over the cited combination. Accordingly, Appellants respectfully request that the Board direct the Examiner to withdraw the rejections and allow the claims.

Improper Combination – Impermissible Hindsight

Appellants respectfully emphasize that there is no appropriate reason to combine the Morgan and Casey references as asserted by the Examiner or as recited in the present claims. Indeed, Appellants respectfully stress that the Examiner has employed impermissible hindsight in combining the references as alleged. The Federal Circuit has warned that the Examiner must not “fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.” *See In re Dembiczak* 50 U.S.P.Q. 2d 52 (Fed. Cir.1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303, 313 (Fed. Cir.1983)); *see also In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988) (explaining that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention).

The Examiner suggested that modifying the Morgan invention to have a rotational period of greater than 8 seconds would be obvious since it would result in higher resolution images. *See* Final Office Action, pages 2-5. The Examiner stated that “it would be well with the capabilities of a person skilled in the art to employ a rotational period of greater than eight seconds to achieve the predictable result of a tomographic image of even higher resolution.” Examiner’s Answer, page 13

(citing *KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d 1385 (U.S. 2007)). The Examiner relied on Casey to teach an eight second rotational period and also an inverse relationship between rotational period and resolution, and proposed to modify the primary reference Morgan to have a rotational period of greater than eight seconds. *See, e.g.*, Examiner's Answer, pages 12, 13, and 15.

However, taking the Examiner's reasoning to its logical conclusion would mean that it would be obvious to increase rotational period to infinity to obtain some maximum resolution. Yet, CT systems are limited in resolution even at greater rotational periods and even with upgrades. Further, Appellants believe that extremely high resolution is generally not needed. To be sure, the skilled artisan would not believe it sensible to increase rotational period to beyond 8 seconds for marginal or no gain in resolution, especially in view of the disadvantages of increased scan time and/or the expensive costs and downtime associated with modifying or upgrading a CT system.

There are a variety of other factors besides resolution to consider in deciding what might be an "obvious" value for rotational period. *See, e.g.*, Appeal Brief, page 8 (explaining that "a decrease in period and corresponding increase in rotation speed of the source is commonly desired to decrease the examination time so to increase patient comfort and/or patient throughput, for example."). Even the Examiner implicitly acknowledged that a desired or "obvious" rotational period is not necessarily a maximum value. *See* Examiner's Answer, page 13 (referring to Casey and asserting that "a person skilled in the art would be motivated to *optimize* the rotational period such that a tomographic image of *appropriate* resolution is obtained) (emphasis added).

There is no objective evidence that either the Morgan or Casey CT systems would achieve higher resolution at a rotational period of greater than eight seconds. And the Examiner has provided no appropriate reason to modify the systems to provide for a rotational period of greater than eight seconds. Moreover, Appellants respectfully contend that the trend in the relevant art, as implied in Morgan, is to increase scan time or *decrease* the period (i.e., *increase the rotation speed* of the source), in direct conflict to the Examiner's proposed modification of Morgan and also to the present claims. *See* Morgan, col. 5, line 65 – col. 6, line 1 (explaining a scenario of "providing a

maximum number of image slices in the shortest time.”). Such a decrease in period and corresponding increase in rotation speed of the source is commonly desired to decrease the examination time so to increase patient comfort and/or patient throughput, for example.

Plainly, the Examiner’s reasoning neglects the clear reasons (such as patient comfort, facility efficiency, and so forth). In the obviousness analysis, one should consider why one of ordinary skill in the art would *not* decrease gantry rotation speed (and in the manner described by the Examiner). To be sure, decreasing gantry rotation speed in the manner described by the Examiner would also increase scan time, particularly if multiple rotations are contemplated. The Examiner has not clearly explained why the skilled artisan would view such a scan time/resolution tradeoff to be worthwhile beyond an eight second rotation period. *See KSR Int’l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d 1385 (U.S. 2007) (explaining that obviousness analysis should be explicit). One of ordinary skill in the art would recognize that, beyond a certain point, increased scan time is not desirable for incrementally better resolution.

The Examiner ignored this point and provides no basis for why one of ordinary skill in the art would believe resolution could be increased by rotating an X-ray source for more than eight seconds. Again, Appellants respectfully assert that the Examiner has employed impermissible hindsight in attempting to modify the Morgan reference to read on the present claims. *See In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). For this additional reason, Appellants respectfully request that the Board direct the Examiner to withdraw the foregoing rejection and allow the claims.

Improper Combination – The References Teach Away

Further, Appellants respectfully emphasize with regard to the modification of Morgan proposed by the Examiner, the cited references teach away from one another and therefore are not properly combinable as desired by the Examiner. Neither the Casey nor Morgan references disclose a clear reason for CT gantries to have rotational periods *greater* than eight seconds (lower rotational speeds). In fact, the Morgan reference makes *no* express disclosure concerning the rotational period

of the X-ray source. To the extent that the Morgan reference is concerned with rotational period, Morgan discusses solving the problem of *long* imaging times and stresses that advantages of the Morgan invention include significantly improved imaging time and imaging in substantially real time. See Morgan, col. 1, lines 26-28 (“One drawback . . . is the relatively long time necessary to generate a plurality of slices.”); col. 1, lines 38-39 (“In order to reduce imaging time . . .”); col. 3, lines 1-5 (“One advantage of the present invention resides in significantly improved imaging time as compared with conventional [systems].”); col. 4, lines 51-53 (discussing reducing time for scan); and col. 5, line 65 – col. 6, line 1 discussing “providing a maximum number of image slices *in the shortest time.*”) (emphasis added).

Clearly, the primary reference Morgan, in which the Examiner proposes to modify, *teaches away* from using an X-ray source with a rotational period *greater* than eight seconds. In view of the stated motivations provided in Morgan for faster, even real-time, imaging, Morgan teaches away from the Examiner’s proposal to modify Morgan to increase scan time. See, e.g., Morgan, col. 3, lines 1-5 (“One advantage of the present invention resides in significantly improved imaging time as compared with conventional single fan beam CT systems.”)..

Lastly, the Examiner stated that “Morgan described [in the background of the reference] conventional CT imaging, which involves obtaining a plurality of slice images sequentially” and that “[o]ne drawback to this type of imaging is the relatively long time necessary to generate a large plurality of image slices, thereby causing the first image slice and the last image slice to be acquired at significantly different times.” Examiner’s Answer, page 14 (citing Morgan, col. 1, lines 21-31. The Examiner concluded that “Morgan disclosed using multiple fan beams to simultaneously acquire a maximum number of image slices in the shortest time, *which has nothing to do with shortening the rotational period.*” Examiner’s Answer, page 14 (emphasis added). To the contrary, Appellants believe the Morgan rotational period will be less. Such a conclusion is even implicit in the Examiner’s comments (quoted above) regarding the shortening of time between the first image slice and last image slice in Morgan. This would seem to necessarily shorten the rotation period. Further, with the emphasis in Morgan on decreasing scan time, and with the

technique taught by Morgan to obtain simultaneous slices, which would apparently result in a shorter rotation period, there is no apparent reason to increase the Morgan rotation period. Indeed, Appellants believe there is none, other than impermissible hindsight gained by Appellant's disclosure.

Accordingly, for this additional reasons, Appellants respectfully request that the Board direct the Examiner to allow independent claims 1, 9, 17, and 25.

Request Withdrawal of Rejections

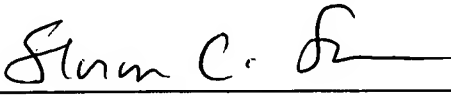
For each of the reasons set forth above, Appellants respectfully request that the Board overturn the Examiner's rejection of independent claims 1, 9, 17, and 25, as well as the claims that depend therefrom.

Conclusion

The foregoing are only reiterative points regarding the reasons why the pending claims are allowable. Appellants rely upon all of the reasons advanced in the Appeal Brief, and respectfully request that the Board carefully review the claims in view of these arguments and indicate the allowability of the claimed subject matter.

Respectfully submitted,

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Floron C. Faries
Reg. No. 59,991
FLETCHER YODER
P.O. Box 692289
Houston, TX 77269-2289
(281) 970-4545